Velho's Cosmographia tables

Dietmar G. Schrausser

Karl-Franzens University, Graz, Austria

Overview

Bartholomeu Velho's *Cosmographia* illustration (1568, fol. 9v–10r) depicting his geocentric model (c.f. Domosh et al., 2020, p. 28) with tables elaborated and recalculated as well as presented with corresponding images of *his* Solar System.

> „ [...] the Bibliotheque Nationale succeeded in acquiring the manuscript in which the Portuguese Bartolomeu Velho summarised his cosmographic knowledge for the benefit of King Charles IX of France [...] This volume consists of 23 cosmographic tavoadas and figuras illustrated by representations of the terrestrial globe on different projections and allegorical figures of the Moon, Mercury, Venus, the Sun, Jupiter and Saturn [...] the work, which Velho compiled at the request of Francisco d'Albagno, remained in the latter's possession and was not delivered to the king owing to the author's death [...] Soon after, it passed to Giovanni Andreozzi [...] who in 1576 offered it to the Grand Duke Francis of Tuscany [...] it was discovered in the library of M. Ferreira das Neves [...] and studied in 1890 [...] The MS. reappeared in the library of Ch. Chadenat, whence it passed into the Bibliotheque Nationale on March 13, 1950 [...] “, (Foncin, 1960, p. 43–44).

See also Codazzi (1964, p. 78) and Cortesão (1965, 2009, respectively).

Table 1. Translation of the headline text.

Language	
Portugues	FIGURA DOS CORPOS CELESTES
English	Picture of the celestial bodies.

Table 2. Display of content and translation of sphere parameters starting at the top right in a clockwise direction (c.f. fig. 1).

Parameter	
Arc length BL	Legoas de hu grao : e cada hu globo celeste Arc length per degree in legues.
Circumference U	Legoas do mayor circulo de cada hu globo C'eleste. Sphere circumference in legues.
Diameter D	Legoas do diametro de cada hu globo celeste. Sphere diameter in legues.
Width b	Legoas da gro sura de cada hu globo cesleste. Sphere width in legues.
Distance d	Legoas ate o centro da terra - de cada hu globo celeste. Distance from the center of the earth or sphere radius in legues.

Arc length BL per degree $\measuredangle^{\circ}$ is calculated by

$$BL_{\measuredangle^{\circ}} = \frac{U}{360},$$

where circumference $U = \pi_0 \cdot D$ and diameter $D = 2 \cdot r$. The *corresponding* circular constant π_0 used by Velho can be derived from given U_0 and D_0 as

$$\pi_0 = \frac{U_0}{D_0} = 3.\overline{142857}$$

or $\pi_0 = \frac{22}{7}$, respectively. Width *b* at given *n* is calculated by

$$b_n = r_n - r_{(n-1)},$$

where radius r equals distance d.

Figure 1.

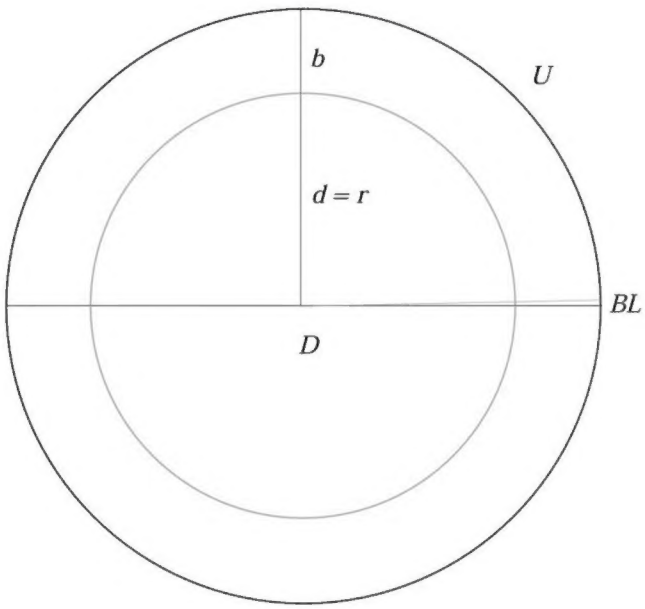


Table 3. Translation of the *rotation* descriptions.

Texto em portogues	*English translation*
R. DA LVA *EN 27 DIAS E 8 ORAS*	Orbital period of the Moon in 27 days and 8 hours.
R. DE MERCVRIO *EN 70 DIAS E 7 ORAS*	Orbital period of Mercury in 70 days and 7 hours.
REVOLVCAO DE VENUS *EN 273 DIAS E 23 ORAS*	Orbital period of Venus in 273 days and 23 hours.
REVOLVCAC DO SOL *EN 365 DIAS E SEIS ORAS*	Orbital period of the Sun in 365 days and six hours.

REVOLVCAO DE MARS EN DOVS ANNOS	Orbital period of Mars in two years.
REVOLVCAO DO CEO D IVPITER EN DOZE ANNOS	Orbital period of the Jupiter sky in twelve years.
REVOLVCAO DO CEO D SATVRNO EN TRINTA ANNOS	Orbital period of the Saturn sky in thirty years.
REVOLVCAO DO CEO DAS ES TRELAS EN 36000 ANOS	Orbital period of the starry sky in 36000 years.
REVOLVCAO DO PRIMO MOBILE EM 24 ORAS	Orbital period of the first mobile in 24 hours.
CELVM EMPIREVM HABITACVLVM DEI ET OMNIVM ELECTORUM	Heaven of the home of God and all chosen ones.

Table 4. Radius r, distances d, res., given in *Legoas* L converted into kilometers km, with *Légua terrestre*[1] $L_t = 6.600\ km$ and *Légua antiga* $L_a = 6.197\ km$ (c.f. Costa, 1994).

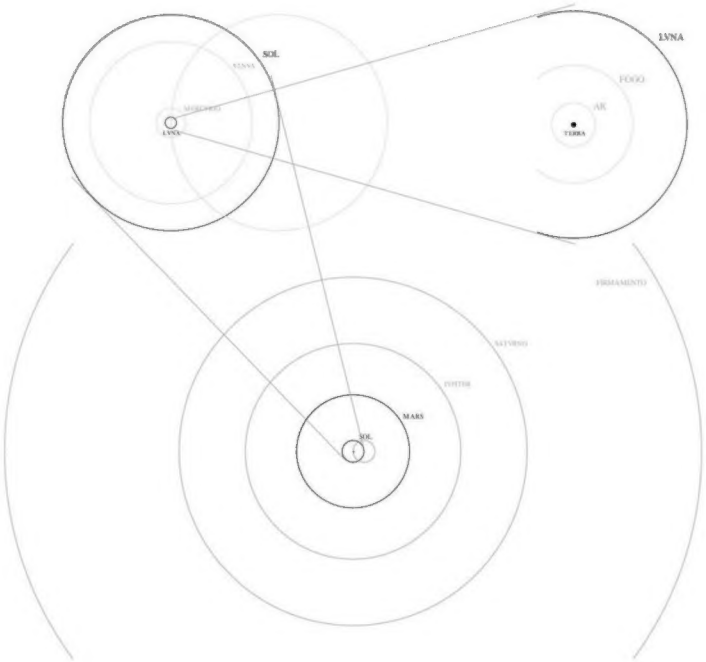
	L_t	L_a
Terra	6 615.00	6 211.08
Ar	66 151.80	62 112.53
Fogo	180 076.05	169 080.50
Luna	344 092.65	323 082.14
Mercurio	895 537.50	840 855.44
Venus	4 974 750.00	4 670 988.75
Sol	6 627 225.00	6 222 562.63
Mars	34 430 550.00	32 328 199.75
Jupiter	65 894 812.50	61 871 235.31
Saturno	104 737 875.00	98 342 516.88
Firmamento	212 577 750.00	199 597 623.75

Velho's universe up to the *firmament* therefore has a size that roughly extends to the *orbit of Mars*, with semimajor axis $d_M = 227\,956\,000\ km$ (c.f. Williams, 2024). For the corresponding *distances* or *sizes* of the spheres c.f. fig. 2.

At this point it also becomes clear that, given the distances shown, it hardly makes any difference in the overall picture whether you place the Earth or the Sun in the center. For further implications see velho_tab01.md, velho_tab02.md tables[2].

[1] Land league in the colonial period of Brazil.
[2] https://zenodo.org/doi/10.5281/zenodo.10689014

Figure 2.



In this context see *Anaxagoras* and his concepts of the *primum mobile* and *nous* (c.f. Ferchius, 1646), *Pythagoras'* doctrine of *musica universalis* (c.f. Davis et al., 1901) and *Plato's* fifth *etheric* element, the *quintessence* (see e.g. Böckh, 1852):

> „As the *eyes*, said I, seem formed for studying *astronomy*, so do the *ears* seem formed for *harmonious motions*: and these seem to be *twin* sciences to one another, as also the Pythagoreans say.", (Davis et al., 1901, p. 252).

For further readings see e.g. Campbell (1978, p. 105), Furtado (2022), Krtalić & McIntosh 2022) or Meirinhos (2022).

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